Eco-toxicology and Control of the Indian Desert Gerbille, *Meriones hurrianae* (Jerdon)

I. Feeding behaviour, energy requirements, and selection of bait

BY

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(*With two figures*)

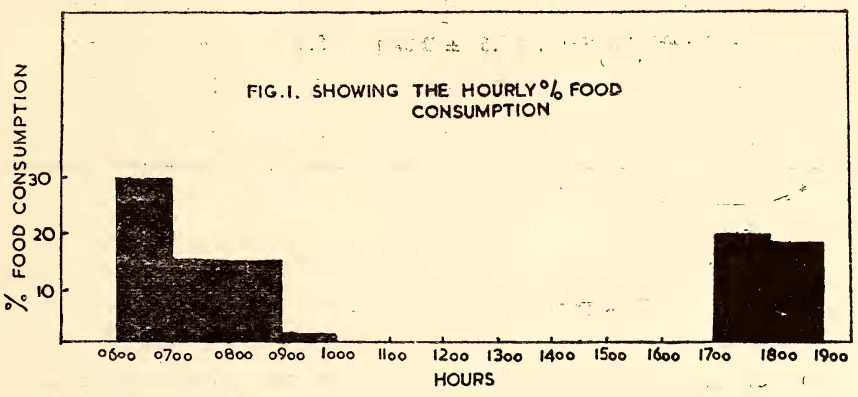
INTRODUCTION

The Indian Desert Gerbille, *Meriones hurrianae* (Jerdon) (Gerbillinae, Rodentia), is the dominant mammal species in the Rajasthan desert (Prakash, 1961). Being a herbivore it is extremely destructive to vegetation (Prakash, 1959a). This was known as early as 1890; the Forest Administration Report of the former Jodhpur State of the year 1890 mentions that during the winter months considerable damage was caused to young seedlings and transplants in Jodhpur plantation by 'field rats' (meaning thereby gerbilles): 'They appeared in swarms and devoured all the young vegetation'. Wagle (1927) declared this gerbille as 'harmless' in rice fields but Prakash (1959, 1959a, 1960, 1962) pointed out its colossal damaging propensities. Recently Ganguli & Kaul (1962) tried two poisons to eradicate this rodent. Since unplanned poisoning is hazardous to farm animals, the minimum lethal dose of the proposed poisons and their toxicity should be studied before measures on a large scale are tried in the field. Also, the correct assessment of the most preferred food of *Meriones* and its daily consumption must be made in order to select a suitable medium for poison-baiting. With this viewpoint trials were conducted in the laboratory. Besides this, the paper deals with feeding behaviour, the effect of various feeds on body weight, particularly that of the seeds of plants found in the natural habitat and of those which are of afforestation importance, and the energy requirements.

Observations and Discussion

Feeding behaviour

Meriones hurrianae is essentially a diurnal species. In nature, it comes out of its burrow for feeding just after dawn and retires after a few hours before it is too warm. It again comes out at about 6 p.m. and retires at 7.30-7.45 p.m. In winter, however, it is out of its burrow throughout the day but not during the mornings and evenings when it is quite cold. Due to human intervention in the laboratory the gerbilles adjusted their feeding times to avoid the working hours (Fig. 1). 62% of the total daily intake was consumed from 6 a.m. to 10 a.m. and the rest between 5 p.m. and 7 p.m. This was observed all the year round.



Total daily intake (TDI)

The gerbilles did not accept any food when they were freshly brought under captivity, although the size of the cage was large, viz. 225×75×75 cm., and not more than six gerbilles were kept in one cage. After 3-4 days the rodents started eating meagre amounts and about 10 days after their capture their TDI became stationary. Table 1 shows the average TDI of various grains and pulses as consumed in 24 hours per gerbille. During this series of experiments only one food item was tried at a time with a group of 6 to 12 gerbilles. Water was provided for drinking during every trial. It is observed that wheat flour is most preferred. Table 1 also shows the calorific values of the various TDI. It is calculated that with food giving 12-15 calories of energy a day, one gerbille of 45-55 gm. weight group can maintain its body weight.

TABLE 1

Average Total Daily Intake of Gerbilles and its Calorific Value*

Food	TDI in gm.	TDI % Body wt.	% moisture	Calorific value of TDI
Wheat flour ..	7.04 ± 0.38	11.3	12.2	24.71
Sorghum, *Sorghum vulgare* ..	6.5 ± 0.28	10.5	11.9	22.11
Millet, *Pennisetum typhoideum.*	5.5 ± 0.26	8.9	12.4	19.8
Moong (green gram), *Phaseolus radiatus* ..	5.0 ± 0.48	8.06	10.4	16.7
Whole wheat, *Triticum aestivum* ..	4.0 ± 0.15	6.4	12.8	13.92
Bengal gram, *Cicer arietinum* ..	4.0 ± 0.56	6.4	9.8	14.0
Maize, *Zea mays* ..	3.8 ± 0.41	6.1	14.9	13.0
Moth, *Phaseolus aconitifolius* ..	3.6 ± 0.67	5.8	—	—
Barley, *Hordeum vulgare* ..	3.4 ± 0.35	5.4	12.5	13.3
Guar, *Cyamopsis tetragonoloba*	1.98 ± 0.30	3·2	—	—

* After Aykroyd *et. al.* (1960)

Seed consumption

It was observed earlier that in nature the gerbilles consume seeds up to 60% in January, and thereafter the percentage decreases to 10 in July; it then increases to 60 in December (Prakash, 1962). Seeds of the following plant species could be identified from the stomach contents of gerbilles which were collected and analysed all the year round: *Cenchrus* spp., *Boerhavia diffusa, Tephrosia purpurea, Crotalaria burhia, Farsetia jacquemontii, Capparis decidua, Zizyphus* spp., *Cynodon dactylon, Trianthema portulacastrum, Cucumis trigonus, Colocynthis vulgaris, Prosopis juliflora,* and *Eragrostis ciliaris.* It was, therefore, considered that the seeds of plants found in the gerbille habitat form their main food. This was confirmed by the Silviculture Section of the Institute, more than 50% of the sown seeds being destroyed by the gerbilles. Therefore, seeds of plants found around gerbille burrows and those of afforestation and grassland importance were given to them to study the seed consumption in 24 hours. Trials were conducted with groups of animals after their adaptation to captivity. In some groups water was provided, and in others the gerbilles were maintained without water, but there was no appreciable difference in the consumption. The data in Table 2 show the average

amount of seeds consumed during 24 hours per gerbille. When compared to millet (*Pennisetum typhoideum*) and sorghum (*Sorghum* sp.) controls, the TDI of seeds is significantly very low. Amongst the grass seeds, those of *Panicum antidotale* were consumed in larger quantities. Next higher consumption was of *Dichanthium annulatum*, *Lasiurus hirsutus*, and *Cenchrus setigerus* seeds. Amongst other plant seeds those of *Zizyphus nummularia* were consumed at the average rate of 1.75 ± 0.65 gm. during 24 hours per gerbille. Seeds of *Acacia* spp. were least consumed.

TABLE 2

Average Seed Consumption per Gerbille during 24 hours

Seeds of	Consumption in 24 hours in gm. per gerbille
1. *Panicum antidotale*	3.25 ± 0.79
2. *Dicanthium annulatum*	2.5 ± 0.76
3. *Lasiurus hirsutus*	2.1 ± 0.48
4. *Cenchrus ciliaris*	0.85 ± 0.25
5. *Cenchrus setigerus*	2.1 ± 0.41
6. *Zizyphus nummularia*	1.75 ± 0.65
7. *Tecomella undulata*	1.50 ± 0.33
8. *Prosopis juliflora*	1.21 ± 0.36
9. *Albizia lebbeck*	1.20 ± 0.40
10. *Aerva tomentosa*	0.66 ± 0.17
11. *Acacia senegal*	0.40 ± 0.05
12. *Acacia arabica*	0.37 ± 0.16

Significance at 5% level Items 2-12 $P < .001$ with millet and sorghum control
Item 1 $P < .01$ with millet control
Item 1 $P < .001$ with sorghum control

Seed preference

There are many factors governing the seed consumption when seeds of only one plant species are provided to gerbilles for preference trials. The seeds may have spines, they may be very hard, or when there is only one food for the starving gerbilles they may be forced to feed upon that particular seed. As in the previous trials, the amount of seed consumption may not be indicative of their true seed

preference. Seeds of various plants were, therefore, given to gerbilles in combinations. The gerbille was placed in a smaller cage (75×75×75 cm.) and the experimental food was given in equal quantities in two petri dishes of the same size. To minimize the factor of availability during every trial the positions of the samples were rotated. Combinations of two and three seeds were tried. The preference was denoted by the amount of seeds consumed during 24 hours. The results are expressed in Tables 3 and 4, following the method of Cott (1951) and Prakash (1957). The arrows point toward the preferred species. By comparing data in Table 2, 3, and 4 it will be observed that the preference and choice of gerbilles is quite consistent.

TABLE 3

Showing Preference of Grass Seeds

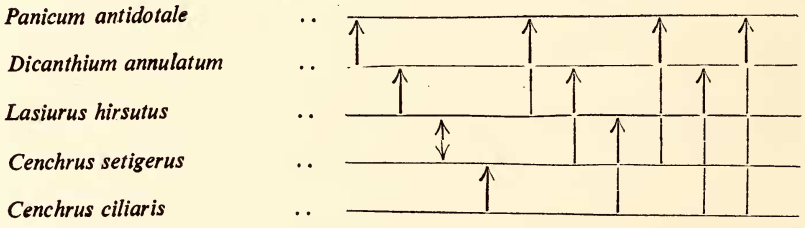
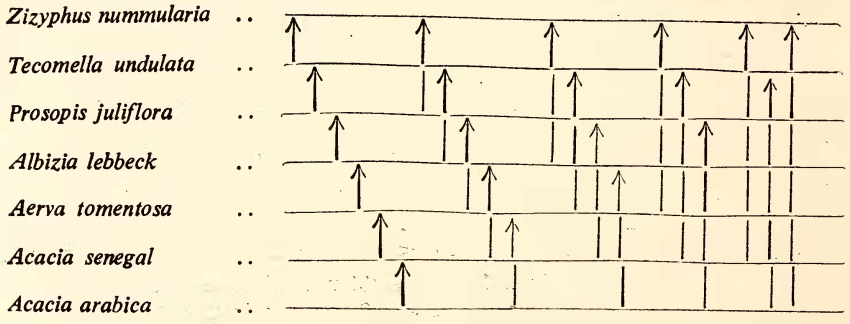


TABLE 4

Showing Preference of other Plant Seeds



Body weight in relation to feeding without water

Meriones practically do not get drinking water in nature. In captivity they readily accept water and on an average a gerbille consumes 2.78 ±0.18 ml. water during 24 hours when being fed on air-dried seeds. To ascertain the influence of water consumption on body weight, wheat was provided to gerbilles with and without water. The experiment lasted for about a month. The group of gerbilles

being fed without water lost weight considerably but the other group maintained body weight (Fig. 2). These results from experiments in captivity are particularly interesting since gerbilles not only maintain but add to their body weight when they do not get any water in nature.

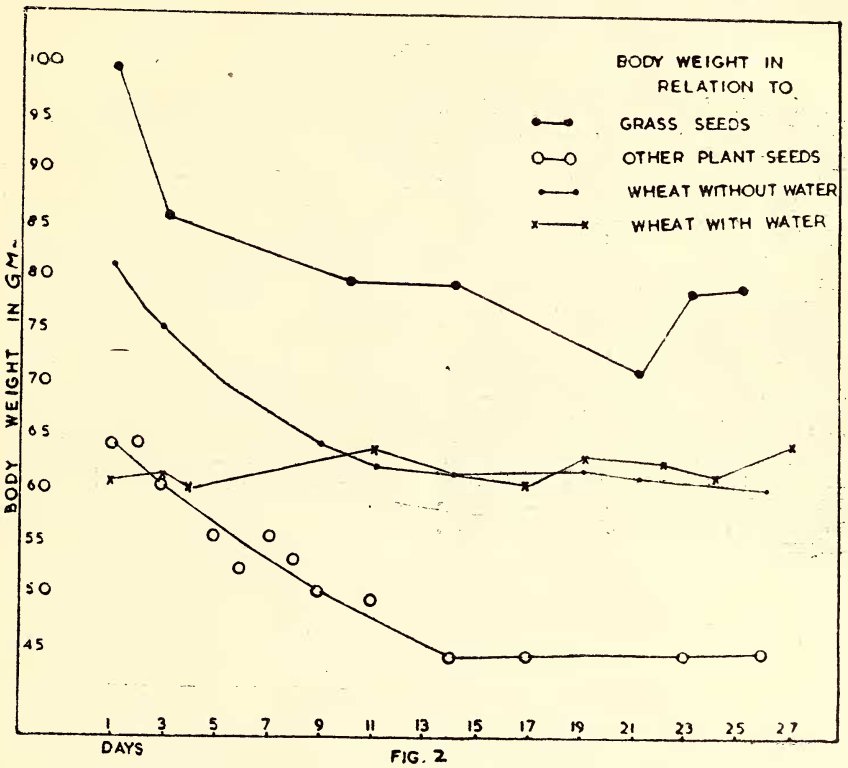


FIG. 2.
. BODY WEIGHT IN RELATION TO VARIOUS FEEDS

Body weight in relation to seed food

The graph (Fig. 2) indicates two curves, one showing the body weight losses when a group of gerbilles was fed on grass seeds and the second shows the body weight on other seeds. Till the 21st day while feeding on grass seeds, the curve declines steeply whereafter there is an increase in body weight, but when the gerbilles were fed on other seeds the body weight fell so much in 12-14 days that the gerbilles started dying and strong cannibalistic tendencies were induced due to starvation. After this critical period the body weight was maintained by the remaining gerbilles of the group.

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